

I claim:

- 5
1. A method for manufacturing bumped conductors for electrically connecting one or more conductors on a first surface to one or more conductors on a second surface, the method comprising melting a metal on the first surface to form metal bumps fused to the conductors on the first surface, the bumps being capable of being bonded to the conductors on the second surface, and the bumps being comprised of a metal having a melting point over 350°C.
2. A method according to claim 1 wherein the metal being melted to form bumps is capable of being metallurgically bonded to the conductors on the second surface.
3. A method according to claim 1 wherein the metal being melted to form bumps is capable of being adhesively bonded to the conductors on the second surface with an organic adhesive.
4. A method according to claim 1, wherein the metal to be melted to form the bumps is selected from the group consisting of aluminum, copper, nickel, silver, gold, and alloys and combinations of those metals.
5. A method according to claim 1, wherein the metal to be melted to form the bumps is strong enough to support the first surface spaced away from the second surface during and after the bonding of the bumps to the conductors on the second surface.
- 20
6. A method according to claim 2, wherein the metal forming the bumps is capable of being

metallurgically bonded to the conductors on the second surface by soldering.

7. A method according to claim 2, wherein the bumps are capable of being metallurgically bonded to the conductors on the second surface by welding.

8. A method for manufacturing bumped conductors for electrically connecting one or more conductors on a first surface to one or more conductors on a second surface, the method comprising:

providing contact areas in the conductive pattern on the first surface that are wettable by a molten metal;

depositing the metal over the contact areas;

melting the metal, the molten metal forming bumps on the contact areas, the bumps being capable of being bonded to the conductors on the second surface, and the bumps being comprised of a metal having a melting point over 350°C.

9. The method of claim 8, wherein the metal being deposited over the wettable contact areas includes some metal being deposited on non-wettable areas contiguous to the wettable area, and upon melting the metal, the molten metal draws back from the non-wettable areas to the wettable contact areas to form the bumps.

10. A method according to claim 8, wherein the metal being melted to form bumps is capable of being metallurgically bonded to the conductors on the second surface.

11. A method according to claim 8, wherein the metal being melted to form bumps is capable of being adhesively bonded to the conductors on the second surface with an organic adhesive.

5 12. In a method according to claim 8, wherein the bumps are formed of a metal selected from the group consisting of aluminum, copper, nickel, silver, gold, and alloys comprising these metals.

13. A method according to claim 8, wherein the metal to be melted to form the bumps is strong enough to support the first surface spaced away from the second surface during and after the bonding of the bumps to the conductors on the second surface.

14. A method according to claim 10, wherein the metal forming the bumps is capable of being metallurgically bonded to the conductors on the second surface by soldering.

15. A method according to claim 10, wherein the bumps are capable of being metallurgically bonded to the conductors on the second surface by welding.

20 16. In a method for manufacturing an electronic package having solderable metal bumps as a connecting means, the improvement comprising:

providing an insulating substrate having metallic pads as a base for the package;

depositing a metal on the substrate over the metallic pads, the metal having a melting

point over 350 °C, and below the melting point of the metal forming the metallic pads;⁷

melting the metal so that it draws back onto the metallic pads, forming metal bumps on the metallic pads.

5 17. In a method for manufacturing an electronic package having metal bumps according to claim 16, wherein the metal is deposited over the metallic pads in a powdered form.

18. In a method for manufacturing an electronic package having metal bumps according to claim 17, wherein the powdered metal is deposited by screen printing.

19. In a method for manufacturing an electronic package having metal bumps according to claim 16, the improvement comprising:

providing the insulating substrate with metallic pads of metals selected from the group consisting of refractory metals and the metals of Groups 8 and 1b of the Periodic Table of Elements and alloys and combinations of those metals;

depositing a lower melting metal selected from the group consisting of aluminum and aluminum alloys, copper and copper alloys, silver and silver alloys, gold and gold alloys, nickel and nickel alloys and combinations of those metals, over the metallic pads; and

20 melting the lower melting metal so that it draws back onto the metallic pads, forming metal bumps on the metallic pads.

20. In the method of manufacturing an electronic package according to claim 19, wherein

the metal of the metallic pads on the insulating substrate are selected from the group consisting of chromium, molybdenum, nickel, tungsten, molybdenum/manganese and titanium/tungsten.

21. In the method of manufacturing an electronic package according to claim 20, wherein the metal forming the bumps comprises copper.

22. In the method of manufacturing an electronic package according to claim 20, wherein the metal forming the bumps is selected from the group consisting of silver, gold, silver alloys and gold alloys.

23. In the method of manufacturing an electronic package according to claim 22, wherein the bumps are coated with a barrier metal capable of preventing the bumps from dissolving in molten solder.

24. In the method of manufacturing an electronic package according to claim 23, wherein the barrier metal is coated with a solder aid to enhance solderability